

# Elevate HEALTH

A quarterly research digest  
of the President's Council on  
Fitness, Sports & Nutrition

Series 16, Number 2  
June 2015



fitness. sports. nutrition.

## Injuries and Adverse Events in Sports Activities: Preventive Strategies for Young Athletes





President's Council on  
Fitness, Sports & Nutrition

# Opening Commentary

Caitlin Cahow, Member  
President's Council on Fitness, Sports & Nutrition

## Guest Authors

R. Dawn Comstock, PhD  
Associate Professor  
Department of Epidemiology, University  
of Colorado Denver, Colorado School of  
Public Health  
Department of Pediatrics, Emergency  
Medicine, University of Colorado School  
of Medicine  
Pediatric Injury Prevention Education and  
Research (PIPER) Program

Lara B. McKenzie, PhD, MA  
Associate Professor  
Center for Injury Research and Policy  
Research Institute at Nationwide  
Children's Hospital  
Department of Pediatrics, College of  
Medicine, The Ohio State University  
Division of Epidemiology, College of Public  
Health, The Ohio State University

## Editor-in-Chief

Jeffrey I. Mechanick, MD, FACP, FACE,  
FACN, ECNU  
Clinical Professor of Medicine  
Director, Metabolic Support  
Division of Endocrinology, Diabetes,  
and Bone Disease  
Icahn School of Medicine at Mount Sinai

## Editorial Board

Alexandra Evans, PhD, MPH  
University of Texas at Austin  
Diane L. Gill, PhD  
University of North Carolina  
at Greensboro  
Rachel K. Johnson, PhD, MPH, RD, FAHA  
University of Vermont  
Leah E. Robinson, PhD  
University of Michigan  
Diane Wiese-Bjornstal, PhD  
University of Minnesota

*The findings and conclusions in this paper  
are those of the authors and do not necessarily  
represent the official position of the President's  
Council on Fitness, Sports & Nutrition or the  
U.S. Department of Health and Human Services.*



Looking back on a career of countless hours spent in the gym and on the ice, the games won and lost and the lessons learned, I am grateful for every moment. But I am most grateful for the opportunities and experiences that hockey has brought me, and the amazing people with whom I have traveled the journey.

Hockey has taught me innumerable lessons about life and about myself. Most significantly, I have learned that even the greatest challenges can become equally great victories with courage, determination, and a proactive, positive attitude.

In 2012, I experienced a severe concussion followed by months of post-concussion syndrome. My days were dark, and at times it was hard to believe that I would be able to overcome this terrible injury. However, with the help, guidance, and support of family, friends, teammates, coaches, and medical professionals, I was able to recover, get back on the ice, and return to pursuing my dreams on and off the ice.

Injuries can seem like major setbacks, but they also provide opportunities to grow as an athlete and as a person. There are wonderful resources available for athletes, coaches, trainers, doctors, and parents who are looking to take a proactive approach. The more we all learn and grow together, the better success we will have in preventing injuries and treating them efficiently when they arise.

R. Dawn Comstock, PhD, and Lara B. McKenzie, PhD, MA, look at the challenges facing parents, physicians, trainers, and coaches as more young athletes take to the playing field. Many of the sports prevention efforts are hampered by a lack of detailed knowledge surrounding the rates and patterns of injuries in youth sports; however, the authors provide detailed prevention strategies designed to keep young athletes safe and healthy so they can play more and spend less time sidelined with injury.

“The greatest challenges can become  
equally great victories with courage, determination,  
and a proactive, positive attitude.”

Caitlin Cahow



# Injuries and Adverse Events in Sports Activities: Preventive Strategies for Young Athletes



*Today most children have shifted from spending time in unstructured play to spending after-school and weekend time in organized sports.*

## Introduction and Definitions

Given our current epidemic of obesity, it is more important than ever to promote youth participation in sports and other physically active recreational pursuits. In fact, daily physical activity is such an important part of a healthy lifestyle that it has been included in *Healthy People* objectives since 1990. *Healthy People 2020* included nine objectives focused on improving physical activity behavior.<sup>1</sup> Finding ways to stay physically active has become more important as our country has moved away from an agriculture-based society and more adults are employed in sedentary jobs, fewer adults walk or bike to work, and fewer children walk or bike to school. As this more sedentary lifestyle has resulted in an increased prevalence of obesity, the importance of physical activity in preventing weight gain and enhancing weight loss has been highlighted.<sup>2</sup> Playing sports and participating in recreational activities has become a more common way for adults to stay physically active, resulting in a sharp rise in the number and competitiveness of Masters athletes.<sup>3</sup> Because promotion of sports participation across the

lifespan should be encouraged, it is important to prevent youth sports injuries because they can result in long-term (e.g., osteoarthritis) as well as short-term negative outcomes.

The way children stay physically active has also changed. In the past, children would gather in streets, backyards, schoolyards, or parks to play, often making up their own games (kick the can, capture the flag, etc.) or modifying popular sports (football, baseball, etc.), given the number of children and type of gear available. Today, despite knowing children respond better to environments that allow and support free play rather than highly supervised environments, and despite great efforts to increase youth physical activity in school and community settings,<sup>4</sup> most children have shifted from spending time in unstructured play to spending after-school and weekend time in organized sports. Organized sports are often coached and administered by adults. In the United States, about 60% of boys and 47% of girls start playing organized team sports before they turn six years old.<sup>5</sup> Despite many physical, social, and emotional benefits of playing sports and increased physical activity,<sup>6</sup> there is a risk of injury associated with any physical activity, especially organized sports.





Given the *Healthy People 2020* objectives to increase children's physical activity, efforts must be made to keep children as safe as possible while they play sports so they can play more and spend less time sidelined with injury.

## Current Problem: Challenges to Sports Injury Prevention Efforts

Detailed knowledge of the rates and patterns of injuries in youth sports, as well as some understanding of risk and protective factors, is needed before effective, targeted, evidence-based sports injury prevention programs can be developed.

Researchers estimate that between 20 and 30 million children from 6 to 17 years of age participate in organized sports in the United States each year. However, no one knows exactly how many U.S. children regularly participate in sports and recreational activities. Additionally, researchers do not know how many young athletes are injured, what types of injuries they sustain, or the

severity of their injuries. Because these estimates don't include children under six years old, the total number of children playing sports is underestimated.<sup>5</sup> Further complicating these estimates is the fact that there are numerous sports governing bodies, ranging from national organizations to local municipalities, recreation departments, and church groups. These sports governing bodies have rough estimates of youth sports participants; however, youth sports teams and leagues can be organized by any group or individual with or without affiliation to any organization. Thus, it is impossible to count the number of young athletes participating in organized sports. Estimating how many children participate in recreational activities beyond organized sports is even more difficult. As the level of nationwide organization increases, so does the accuracy of estimates of how many children play. For example, based on annual participation surveys conducted by the National Federation of State High School Associations (NFHS), the number of students participating in high school-sponsored sports has increased for 25 years in a row. Nearly 7.8 million students played high school sports in the 2013–14 school year.<sup>7</sup>

Many parents encourage their children to play sports because of their emotional, physical, and social benefits. However, that encouragement is tempered by the fact that most parents fear that their child may be injured on the field. This fear is supported by reports that 27% of girls and 29% of boys who quit playing organized sports said they quit because of health problems or injuries.<sup>5</sup> This highlights the need to find ways to keep kids as safe as possible while they play sports.

As physical activity patterns in the United States have changed over time, injury prevention efforts also have needed to change. Unfortunately, most national injury prevention efforts have continued to focus on preventing workplace injury, roadway injury, interpersonal violence, poisoning, etc. Each of these prevention efforts is important; however, little work has focused on preventing sports injuries. For example, when many Americans worked in physically active jobs, the federal government established organizations such as the Occupational Safety & Health Administration (OSHA)<sup>8</sup> and the National Institute for Occupational Safety and Health (NIOSH)<sup>9</sup> to work to improve the health and safety of workers. Despite patterns of physical activity in the United States moving away from spending time in physical work and toward spending time playing sports, the only federal organization tasked with preventing sports injuries is the Centers for Disease Control and Prevention National Center for Injury Prevention and Control (NCIPC).<sup>10</sup> However, NCIPC works to prevent all sorts of injuries, including those from motor vehicle crashes, poisoning, intimate partner violence, etc. Sports injury prevention is just a small part of NCIPC's workload.



## New Information

### Injuries and Adverse Events in Youth Sports

The true number of sports injuries and adverse events among young athletes is unknown, but it is possible to generalize some research findings. For example, based on surveillance of injuries presenting to emergency departments (ED), while there was a decrease over the past 10 years in injuries from recreational activities like bicycling, roller skating, and trampolines, there was an increase in injuries from sports like football and soccer.<sup>11</sup> However, ED records do not provide reliable numbers of sports injuries because many injured athletes seek care in other clinical settings such as urgent care centers, pediatric sports medicine clinics, adolescent medicine clinics, pediatricians' offices, and school athletic training rooms. One study reported the number of Americans receiving medical attention for sports- or recreation-related injuries was 42% higher than estimates based on sports injuries treated in EDs.<sup>12</sup> ED records also often fail to distinguish between injuries sustained during organized sports vs. recreational activities.

Just as the true number of sports and recreation injuries is unknown, so too is their cost, although it could be as high as billions of dollars each year. For example, one ED-based study in a single state found that from 2010–12, sports and recreation injuries represented one-fifth of all ED visits and cost more than \$40 million.<sup>13</sup> Another national study of ED visits from 2008–10 found injuries from sports such as football, basketball, bicycling, baseball/softball, and soccer were the leading cause of injury costs among children 5 to 24 years old.<sup>14</sup> The high number of children injured from sports and recreation activities, coupled with the high cost of their care, shows there is a need to increase efforts to keep young athletes as safe as possible while they play.

Parents and coaches should help young athletes keep sports in perspective by emphasizing fun over winning, improving skills over personal statistics, and building friendships over personal achievements. Parents and coaches must remember that sports are supposed to be fun for young athletes and should not place too much importance on their accomplishments.



*Basketball results in a larger number of injuries than full-contact sports, if injuries sustained during both organized sports and recreational sports activities are considered.*



Although injury rates and patterns vary widely by sport, level of competitiveness, and children's age, some findings have remained consistent across multiple studies. Children, adolescents, and young adults (i.e., those ages 5 to 25) make up the largest number of sports and recreation-related injuries and also have the highest rates of injury. Injury rates tend to increase as athlete age and/or competitive level increases. Strains and sprains are the most common type of injury. The lower extremities are the most commonly injured body site. Head injury (e.g., concussion) rates have increased significantly over the past decade. Males have higher rates of sports and recreation injuries than females. Although full-contact sports (e.g., football, ice hockey, boys' lacrosse) have higher injury rates than other popular sports, basketball results in a larger number of injuries, if injuries sustained during both organized sports and recreational sports activities are considered.<sup>12,13,15</sup> It is also generally accepted that while some degree of sports specialization may be necessary to develop elite-level skills, having young children focus on just one sport places them at higher risk of injury, psychological stress, and the possibility of quitting sports. Intense training in a single sport, at the exclusion of others, should be delayed until the teenage years.<sup>16</sup>

Emergency department records do not provide reliable numbers of sports injuries because many injured athletes seek care in other clinical settings.



While such overall patterns are relatively consistent, some sports injuries of particular concern have more specific injury patterns that differ. For example, although full-contact sports (e.g., football, boys' ice hockey, and boys' lacrosse) have the highest concussion rates among high school athletes, in gender-comparable sports, girls have higher concussion rates than boys.<sup>17</sup> Also, across sports and recreational activities, younger athletes who sustain concussion may have more prolonged recovery compared to older athletes.<sup>18</sup> Additionally, heat illness, a rare adverse event but a serious one due to its potential lethality, has a strong sport and seasonal component. Most heat illness incidents occur from July through September and in the sport of football.<sup>19,20</sup> Although rare, cardiac events were the leading cause of death among high school and college football players from 1990–2010,<sup>21</sup> and some specific groups of athletes, including men, African Americans, and basketball players, appear to be at higher risk of sudden cardiac death.<sup>22</sup> Understanding both broad general patterns as well as sport- and injury-specific patterns is essential to drive the development of effective, targeted injury prevention programs.

### **Injury Prevention Methods Adapted to Sports**

Public health professionals have developed a series of successful prevention methods, which have resulted in dramatic improvements in efforts to prevent motor vehicle injuries, occupational injuries, and poisonings. Unfortunately, sports injuries have too often been considered by many to be “just part of the game” or “the price you have to pay to play.” In other words, they were considered unavoidable accidents rather than preventable events. By applying proven methods, similar successes are happening in sports. To help frame this discussion of sports injury prevention strategies, two common prevention methods are described below. Sports injury and adverse event examples are shown to demonstrate their potential.

*Coaches should know the signs and symptoms of concussion and understand that a young athlete suspected of having a concussion must be removed from the game and evaluated by a medical provider.*

*Young athletes must be taught that it is not all right to attempt to hide an injury or to try to play through an injury.*

### **The Public Health Approach**

The public health approach is a stepwise method for identifying and addressing public health concerns. With respect to sports injuries, the first step toward prevention is developing a better understanding of the current rates and patterns of sports injury, the second step is collecting and evaluating information on potential sports-related risk and protective factors, the third step is developing sports injury prevention interventions, and the fourth step is implementing and evaluating those interventions “in the field” among athletic populations. Frequently with sports injuries, the public health approach is stuck in steps 1 and 2. Before sports injury prevention programs can be developed, an idea of the frequency and burden of the problem, as well as the “who, what, where, when, and why” of these injuries, needs to be developed. Unfortunately, this basic knowledge can be hard to obtain, as there are few national sports injury surveillance systems. Currently in the United States, most sports injury data comes from published reports of clinical records (i.e., emergency department, orthopedic clinic, and sports medicine clinic records) or from one of a few national or regional/local sports injury surveillance systems.



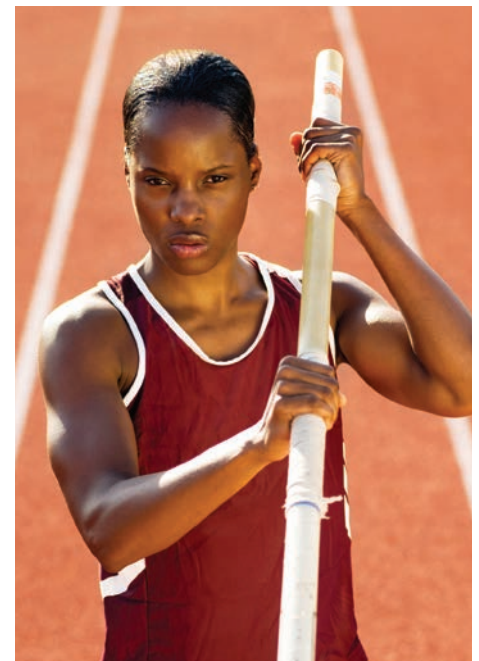


An example of applying the public health approach to sports injury is the work of Dr. Fred Mueller of the National Center for Catastrophic Sport Injury Research (NCCSIR).<sup>23</sup> In 1982, when evaluating data captured by NCCSIR, Dr. Mueller noted there had been four pole-vaulting deaths (Public Health Approach Step 1: Define the Problem). These deaths happened when athletes either missed the landing pit completely or bounced out of the landing pit (Public Health Approach Step 2: Identify Injury Risk Factors). Dr. Mueller continued looking into this risk factor while working with coaches, policy makers, and equipment manufacturers to develop a way to prevent such pole-vaulting deaths (Public Health Approach Step 3: Develop Interventions). Eventually, in 2003, there were several rule changes for pole vaulting, including enlarging the size of the landing pit. Dr. Mueller continued to look at the surveillance data over time and was able to demonstrate that these new rules resulted in a significant

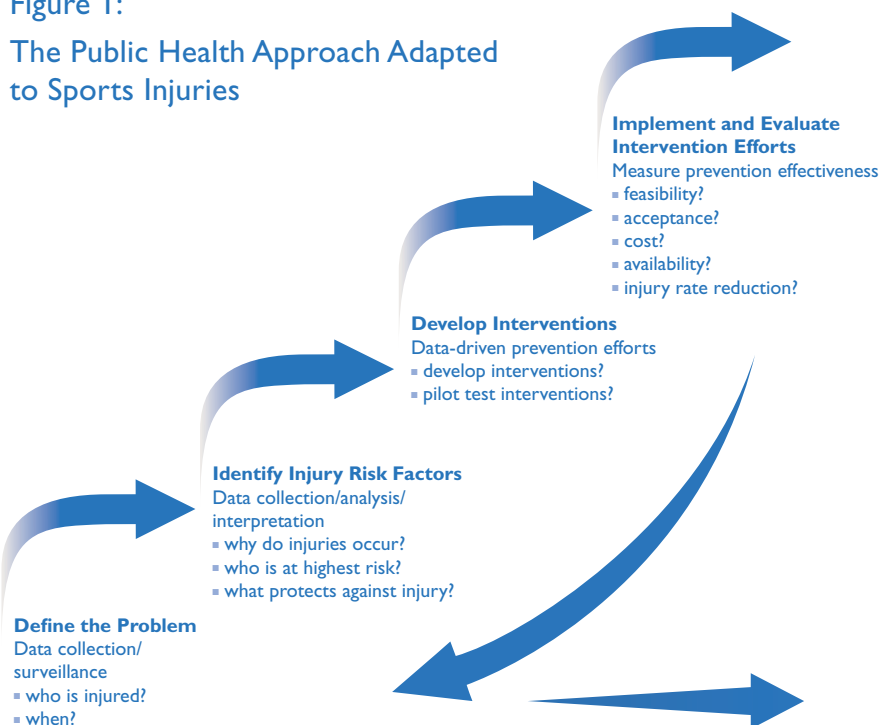


Today we possess full knowledge of the causes of and risk factors for exertional heat illness, how to prevent it, and how to treat it to prevent deaths. Yet a small number of athletes continue to die from exertional heat illness even though every one of these deaths is preventable.

reduction in pole-vaulting deaths from athletes missing or bouncing out of the landing pit<sup>24</sup> (Public Health Approach Step 4: Implement and Evaluate Intervention Efforts). As shown in Figure 1 by the arrow leading from Step 4 back to Step 1, Dr. Mueller's work was not finished.



**Figure 1:**  
**The Public Health Approach Adapted to Sports Injuries**



He identified a new risk factor for pole-vaulting deaths—athletes who failed to make it over the bar and landed head first in the plant box. By again applying the public health approach, a new piece of protective equipment (a padded collar for the plant box) was developed. This demonstrates the value of the public health approach in injury prevention.

## The Three-Legged Stool of Prevention

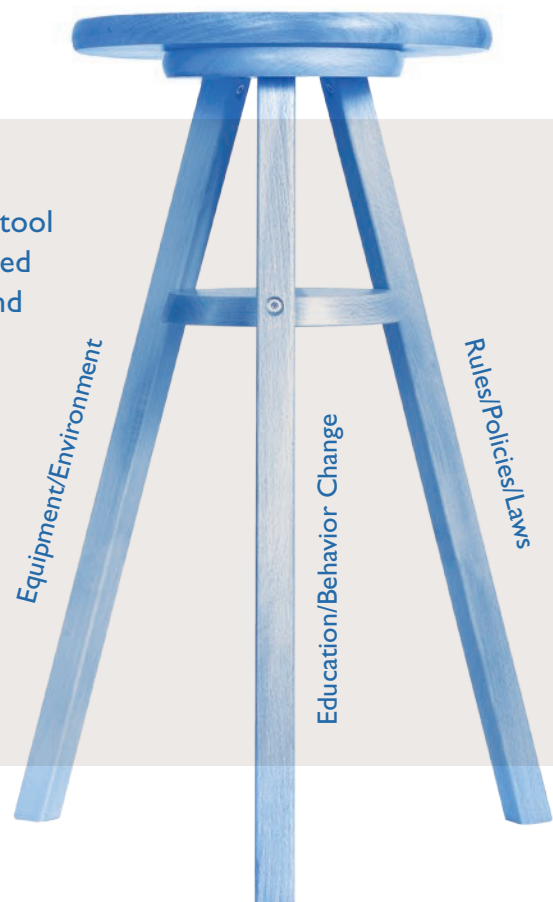
The three-legged stool of prevention is a way to visualize the concept that the best way to prevent injuries is often multifaceted. All three legs are needed for the stool (or program) to remain standing (for the program to do its job). When thinking about sports injuries, this means there is a need to understand that while new protective gear, education aimed at changing risky behavior, or rule changes may each have some effect on reducing injuries, a combination of these factors usually has a much greater effect and greater likelihood of injury reduction/prevention. For example, even the best protective gear is not effective if it is not properly fitted and consistently worn. This means rules requiring athletes to wear specific protective gear, coupled with education for parents and coaches on how to properly fit that gear to young athletes, significantly improves the protective gear's effectiveness.

An example of an application of the three-legged stool of prevention to sports is the adoption of the National Athletic Trainers' Association (NATA) position statement on exertional heat illness (e.g., exercise-associated heat stroke).<sup>25</sup> This document has several suggestions centered on the first leg of the stool—equipment/environment (i.e., how to prevent, recognize, evaluate, and treat exertional heat illness). These include



## Sports Injury Prevention

Figure 2:  
The Three-Legged Stool of Prevention Adapted to Sports Injuries and Adverse Events



regularly checking the wet-bulb globe temperature, which is an environmental measurement, or temperature and humidity during the day; ensuring fluids are available and accessible; having shaded or air conditioned areas available for athletes to use to cool down; having fans available to assist evaporation when cooling athletes; and having a kiddie pool filled with ice/cold water available on hot and humid days to quickly cool athletes who suffer from heat stroke. There are also multiple suggestions centered on the second leg of the stool—education/behavior change. Those include challenging unsafe coaches' rules (e.g., limiting water breaks or refusing to change practice times), encouraging athletes to drink before feeling thirsty and to be well hydrated at the start of practice, teaching athletes how to check urine color, and educating coaches and athletes about the signs and symptoms of heat illness. Today we possess full knowledge of the causes of and risk factors for exertional heat illness, how to prevent it, and how to treat it to prevent deaths. Yet a small number of

athletes continue to die from exertional heat illness even though every one of these deaths is preventable. What is lacking in some states is the use of the third leg of the stool—rules, policies, and laws. High schools in states with mandated exertional heat illness prevention guidelines are more likely to follow the NATA suggestions, and they implemented more of the suggested ways to prevent exertional heat deaths than high schools in states without such regulations.<sup>26</sup> This shows that including all three legs of the stool of prevention leads to better sports injury and adverse event prevention efforts.

*What is lacking in some states is the use of the third leg of the stool—rules, policies, and laws.*



## Prevention Strategies

Efforts to prevent sports injuries have usually been led by sports groups or other groups interested in keeping children safe and healthy. For example, nongovernmental organizations (NGOs) such as Safe Kids Worldwide<sup>27</sup> and Stop Sports Injuries<sup>28</sup> provide education for parents and coaches of young athletes, while the National Operating Committee on Standards for Athletic Equipment (NOCSAE)<sup>29</sup> and ASTM International (formerly known as the American Society for Testing and Materials)<sup>30</sup> set manufacturing standards for sports and safety gear. Sports ruling bodies like the National Collegiate Athletic Association (NCAA),<sup>31</sup> the NFHS,<sup>32</sup> USA Football,<sup>33</sup> and Pop Warner<sup>34</sup> provide educational information to parents and coaches of young athletes and support research and outreach efforts to increase sports safety and improve athlete health. National professional clinical groups like the American Academy of Pediatrics (AAP),<sup>35</sup> the American College of Sports Medicine (ACSM),<sup>36</sup> the American Orthopaedic Society for Sports Medicine (AOSSM),<sup>37</sup> and NATA<sup>38</sup> provide education for parents and coaches through position/consensus statements. Finally, academic sports injury surveillance, epidemiology, and prevention research programs like the NCCSIR,<sup>39</sup> the National High School Sports-Related Injury Surveillance Study (High School RIO),<sup>40</sup> and the Datalys Center<sup>41</sup> work to provide the surveillance data needed to describe rates and patterns of sports injury, investigate risk and protective factors, and drive the development and evaluation of injury prevention programs.



Unfortunately, there is little evidence regarding the effectiveness of most injury prevention efforts currently being used in youth sports. There have been surprisingly few well-designed research studies evaluating sports injury prevention projects.<sup>42</sup> However, a set of prevention strategies emerges when proven injury prevention methods such as the public health approach and the three-legged stool of prevention are applied to the growing knowledge of the many groups working to improve athlete health and safety. Coaches and parents of young athletes should work to adopt as many of the following prevention strategies as possible. They should also continue to watch for new prevention strategies as they become available.

By working together parents, coaches, policy makers, clinicians, and researchers can make children's sports safer. To achieve this, sports injury prevention strategies must focus on high-risk sports, on populations most often injured, on places where injuries happen most often, on the specific activities that most commonly lead to injury, and on reducing specific high-risk behaviors while increasing safety behaviors.



*Coaches and parents of young athletes should work to adopt as many prevention strategies as possible and watch for new strategies as they become available.*

## Athlete-Specific Strategies

Parents and coaches should ensure young athletes are healthy and physically able to perform all athletic demands of the specific sport. Although pre-participation physical exams (PPEs) are required by many sports organizations in the United States, there is limited research about how effective PPEs are in preventing sports injuries by identifying young athletes at high risk of injury.<sup>43</sup> To ensure PPEs are effective, they should be thorough and should be performed by properly trained, knowledgeable physicians.

When possible, parents should have young athletes compete against children of similar size and age. Parents should be cautious when deciding if young athletes should be allowed to “play up” (i.e., play against older athletes). Parents should think about their child’s physical and mental maturity as well as their skills.

Parents and coaches should help young athletes keep sports in perspective. Parents and coaches should emphasize fun over winning, improving skills over personal statistics, and building friendships over personal achievements. Parents and coaches must remember that sports are supposed to be fun for young athletes and should not place too much importance on young athletes’ accomplishments. Parents must be sure they don’t “treat their young athletes like their own personal trophies.”

Parents and coaches should make sure young athletes eat a healthy, balanced diet with an emphasis on whole grains, fruits and vegetables, lean protein, and low-fat dairy. Parents and coaches should make sure young athletes hydrate properly before, during, and after sports.

Parents and coaches must teach young athletes the rules of the sports they play and make sure they understand rules provide a fair playing field and keep athletes safe. Make sure all participants value sportsmanship.

Parents and coaches should monitor young athletes closely for signs and symptoms of injury or adverse health events like exertional heat illness. Parents and coaches should make sure young athletes understand the importance of reporting their own injuries as well as when their teammates are injured. Young athletes must be taught that it is not all right to attempt to hide an injury or to try to play through an injury.

## Equipment-Specific Strategies

Parents and coaches should ensure all required protective gear is new or reconditioned (if appropriate), is in good repair, is fitted properly (fit should be rechecked several times throughout the season), and is worn at all times. All required protective gear should be used in all practice activities.

Parents and coaches should promote use of optional protective gear allowed by, but not required by, the rules of the sport (e.g., mouth guards in basketball, baseball and softball pitchers’ helmets).

Parents and coaches should make sure all sports equipment (ice hockey and lacrosse sticks, baseball and softball bats, etc.) is sized properly for the age and size of the athlete, is in good repair (e.g., no sharp edges, no loose parts), and is used correctly. Sports equipment should not be used for horseplay.

Parents and coaches should make sure young athletes wear the most appropriate type of shoe for their sport and the type of surface they play on (grass, field turf, etc.), that their shoes are the correct size, and their shoes are not damaged (e.g., replace or repair cleats if sharp edges develop).

To prevent skin infections, all uniforms and protective gear should be cleaned regularly.

Parents and coaches should make sure young athletes understand the limitations of protective gear. Young athletes must be taught that helmets do not provide complete protection against head injury. Specifically, parents,

coaches, and young athletes must be aware that concussions can occur regardless of the type/cost of helmet worn,<sup>44</sup> and everyone should work to reduce blows to the head.

## Environment-Specific Strategies

Coaches and parents should monitor general environmental conditions, including severe weather warnings, at practices and competitions. Coaches, parents, and athletes should know where to go for safe shelter in case of inclement weather (e.g., tornado, lightning, flash flood).

Coaches, parents, and athletes should know the signs and symptoms of exertional heat illness. Coaches should monitor wet-bulb globe temperatures or temperature and humidity readings, should alter practice plans or cancel practice if needed to limit heat exposure in extreme conditions (e.g., move practice to early morning or late evening, shorten practice time, add extra water breaks in the shade or air-conditioning), and should make sure athletes are well hydrated before, during, and after sports activities. Parents must insist coaches follow these and other well-documented methods to prevent potentially deadly exertional heat illness.<sup>25</sup>

Coaches and parents should make sure practice and competition playing areas are safe for the specific sports activity (e.g., level playing fields free of holes, protruding sprinkler heads, or hard covers for sewer or water pipe access; adequate open space immediately outside field/court boundaries to allow athletes running/falling out of bounds ample room to decelerate safely) and, during competitions, should bring any safety concerns to the attention of game officials.

Coaches and parents should insist that authorities responsible for practice and competition environments have venue-specific emergency action plans on file,<sup>45</sup> that an individual responsible for activating the emergency action plan in an emergency situation is on site while young athletes are practicing or playing, that first aid equipment (e.g., first aid kit,) is accessible, and that emergency medical services (EMS) have access to the playing venue (e.g., are not blocked by parked cars or locked gates).

## Coaching-Specific Strategies

Coaches should follow available national standards for coaching young athletes.<sup>46</sup>

Coaches should understand all of the rules and techniques of the sport they coach and should take advantage of any of the numerous, readily available, and free or inexpensive coach education materials (e.g., the NFHS Coach Certification Courses,<sup>47</sup> the USA Football Coach Membership<sup>48</sup>) to improve their coaching skills and to stay abreast of rule changes and new coaching techniques.

Coaches should be knowledgeable of specific injury risks in sports they coach and should develop risk-minimization strategies for their practices and their approach to competition. Coaches should, when possible, implement appropriate injury prevention efforts specific to their sport (e.g., limiting full-contact drills in football practice,<sup>49</sup> limiting body checking in youth ice hockey,<sup>50</sup> and incorporating ACL prevention drills such as neuromuscular training into practice time in sports like soccer and basketball).<sup>51</sup>

Coaches and parents should know the signs and symptoms of concussion, should understand that a young athlete suspected of having a concussion must be immediately removed from play and evaluated by an appropriate medical provider, and should understand the general return-to-play protocols<sup>52</sup> as well as any specific protocols outlined in their state’s concussion legislation.



## Conclusion

Sports and recreation injuries and adverse events are preventable. Researchers and policy makers continue to expand the capture and evaluation of surveillance data to improve our knowledge of the rates, patterns, and risk factors of sports injury. They also continue to work to couple this knowledge with proven injury prevention methods to drive the development, implementation, and evaluation of effective, targeted prevention programs. While this has resulted in an overall improvement in sports safety, there is much more to be done. Parents and coaches of young athletes play a crucial role in preventing sports-related injuries. By understanding the specific risks associated with any sport and demanding that proven prevention strategies are implemented, they can help minimize the likelihood that their young athletes will experience a sports injury.



*Intense training in a single sport, at the exclusion of others, should be delayed until the teenage years.*



### Scientific Summary

Diane L. Gill, PhD

PCFSN Science Board

Professor, Department of Kinesiology, University of North Carolina at Greensboro

In this issue of *Elevate Health*, Comstock and McKenzie address the important issue of injury risk and prevention in youth sports. Physical activity is key to healthy development, and organized sports are the primary venue for youth physical activity and its many benefits. At the same time, sports are a primary site for youth injuries. Although research is limited and precise numbers are elusive, it is clear that both participation rates and injury rates in youth sports are high and increasing. As the authors report, youth and young adults (ages 5–25) have the greatest number and highest rates of sport-related injuries, but youth sports lack consistent policies and formal regulations to ensure safe programs.

The authors make a compelling case for injury prevention efforts following the public health approach, with steps moving from developing a better understanding of injury rates and patterns to implementing and evaluating prevention efforts. Research is needed at the first step to provide stronger evidence on injury (who is injured, what types of injuries, etc.) and injury risk factors. Then we especially need research on the implementation and evaluation of injury prevention efforts. That research, along with more consistent reports and policies, can provide evidence and guidance for parents and coaches, who play a key role in preventing injuries and ensuring that sport is a safe, healthy, and positive experience for our youth.

# References



Parents and coaches should promote the use of optional protective gear allowed by, but not required by, the rules of the sport.

1. Fulton JE, Wargo J, Loustalot F (2011). *Healthy People 2020: Physical activity objectives for the future*. President's Council on Fitness, Sports & Nutrition, *Research Digest*, 12(2), 1–16.
2. Jakicic JM, Rogers RJ (2013). The importance of physical activity for losing weight, maintaining weight, and preventing weight gain. President's Council on Fitness, Sports & Nutrition, *Research Digest*, 14(2), 1–9.
3. Kelley RC, Volpe SL (2014). Masters athletes: Competitive sports and sports nutrition for older adults. *Elevate Health*, 15(2), 1–11.
4. Bassett DR, Erwin P, Fitzhugh EC, Frederick V, Wolff DL, Welch WA (2013). President's Council on Fitness, Sports & Nutrition, *Research Digest*, 14(1), 1–10.
5. ESPN. Hey, data data—swing! The hidden demographics of youth sports. Originally published July 11, 2013. Accessed March 9, 2015, at [espn.go.com/espn/story/\\_/id/9469252/hidden-demographics-youth-sports-espn-magazine](http://espn.go.com/espn/story/_/id/9469252/hidden-demographics-youth-sports-espn-magazine).
6. Gould D, Cowburn I, Shields A (2014). “Sports for All”—Summary of the evidence of psychological and social outcomes of participation. *Elevate Health*, 15(3), 1–14.
7. National Federation of State High School Associations. High School Participation Increases for 25th Consecutive Year. Accessed March 9, 2015, at [www.nfhs.org/articles/high-school-participation-increases-for-25th-consecutive-year/](http://www.nfhs.org/articles/high-school-participation-increases-for-25th-consecutive-year/).
8. Occupational Safety & Health Administration. Accessed March 9, 2015, at [www.osha.gov/](http://www.osha.gov/).
9. National Institute for Occupational Safety and Health. Accessed March 9, 2015, at [www.cdc.gov/niosh/](http://www.cdc.gov/niosh/).
10. Centers for Disease Control and Prevention, National Center for Injury Prevention and Control. Home and recreational safety. Accessed March 9, 2015, at [www.cdc.gov/homeandrecreationsafety/](http://www.cdc.gov/homeandrecreationsafety/).
11. Lykissas MG, Eismann EA, Parikh SN (2013). Trends in pediatric sports-related and recreation-related injuries in the United States in the last decade. *Journal of Pediatric Orthopaedics*, 33(8), 803–10.
12. Conn JM, Annett JL, Gilchrist J (2003). Sports and recreation related injury episodes in the U.S. population, 1997–99. *Injury Prevention*, 9(2), 117–23.
13. Howard AF, Costich JF, Mattacola CG, Slavova S, Bush HM, Scutchfield FD (2014). A statewide assessment of youth sports- and recreation-related injuries using emergency department administrative records. *Journal of Adolescent Health*, 55(5), 627–32.
14. Lawrence BA, Spicer RS, Miller TR (2015). A fresh look at the costs of non-fatal consumer product injuries. *Injury Prevention*, 21(1), 23–9.
15. Comstock RD, Knox C, Yard E, Gilchrist J (2006). Sports-related injuries among high school athletes—United States, 2005–06 School Year. *Morbidity and Mortality Weekly Report*, 55(38), 1037–40.
16. Jayanthi N, Pinkham C, Dugas L, Patrick B, Labella C (2013). Sports specialization in young athletes: Evidence-based recommendations. *Sports Health*, 5(3), 251–7.
17. Marar M, McIlvain NM, Fields SK, Comstock RD (2012). Epidemiology of concussions among United States high school athletes in 20 Sports. *American Journal of Sports Medicine*, 40(4), 747–55.
18. Harmon KG, Drezner JA, Gammons M, Guskiewicz KM, Halstead M, Herring SA, Kutcher JS, Pana A, Putukian M, Roberts WO (2013). American Medical Society for Sports Medicine position statement: Concussion in sport. *British Journal of Sports Medicine*, 47(1), 15–26.
19. Gilchrist J, Haileyesus T, Murphy MW, Yard EE (2011). Nonfatal Sports and Recreation Heat Illness Treated in Hospital Emergency Departments—United States, 2001–2009. *Morbidity and Mortality Weekly Report*, 60(29), 977–80.
20. Gilchrist J, Haileyesus T, Murphy M, Comstock RD, Collins C, McIlvain N, and Yard E (2010). Heat Illness among High School Athletes—United States, 2005–2009. *Morbidity and Mortality Weekly Report*, 59(32), 1009–13.
21. Boden BP, Breit I, Beachler JA, Williams A, Mueller FO (2013). Fatalities in High School and College Football Players. *American Journal of Sports Medicine*, 41(5), 1108–16.
22. Harmon KG, Drezner JA, Wilson MG, Sharma S (2014). Incidence of Sudden Cardiac Death in Athletes: a State-of-the-Art Review. *Heart*, 100(16), 1227–34.
23. National Center for Catastrophic Sport Injury Research. Fred Mueller. Accessed March 9, 2015, at [nccsir.unc.edu/about/history/fred-mueller/](http://nccsir.unc.edu/about/history/fred-mueller/).



## Parents and coaches must teach young athletes the rules of the sports they play.



24. Boden BP, Boden MG, Peter RG, Mueller FO, Johnson JE (2012). Catastrophic Injuries in Pole Vaulters: a Prospective 9-Year Follow-Up Study. *American Journal of Sports Medicine*, 40(7), 1488–94.
25. Binkley HM, Beckett J, Casa DJ, Kleiner DM, Plummer PE (2003). National Athletic Trainers' Association Position Statement: Exertional Heat Illness. *Journal of Athletic Training*, 37(3), 329–43.
26. Kerr ZY, Marshall SW, Comstock RD, Casa DJ (2014). Implementing Exertional Heat Illness Prevention Strategies in US High School Football. *Medicine & Science in Sports & Exercise*, 46(1), 124–30.
27. Safe Kids Worldwide. Accessed March 9, 2015, at [www.safekids.org/who-we-are](http://www.safekids.org/who-we-are).
28. Stop Sports Injuries. Sport Specific Injury Information. Accessed March 9, 2015, at [www.stopsportsinjuries.org/sports-injury-prevention.aspx](http://www.stopsportsinjuries.org/sports-injury-prevention.aspx).
29. National Operating Committee on Standards for Athletic Equipment. Accessed March 9, 2015, at [nocsae.org/](http://nocsae.org/).
30. ASTM International. Sports & Leisure Standards. Accessed March 9, 2015, at [www.astm.org/industry/sports-and-leisure-standards.html](http://www.astm.org/industry/sports-and-leisure-standards.html).
31. National Collegiate Athletic Association. Accessed March 9, 2015, at [www.ncaa.org/health-and-safety/sport-science-institute](http://www.ncaa.org/health-and-safety/sport-science-institute).
32. National Federation of State High School Associations. Sports Medicine. Accessed March 9, 2015, at [www.nfhs.org/resources/sports-medicine/](http://www.nfhs.org/resources/sports-medicine/).
33. USA Football. Accessed March 9, 2015, at [usafootball.com/health-safety/home](http://usafootball.com/health-safety/home).
34. Pop Warner. Accessed March 9, 2015, at [www.popwarner.com/safety.htm](http://www.popwarner.com/safety.htm).
35. American Academy of Pediatrics. Council on Sports Medicine and Fitness Policy Collections. Accessed March 9, 2015, at [pediatrics.aappublications.org/cgi/collection/council\\_on\\_sports\\_medicine\\_and\\_fitness](http://pediatrics.aappublications.org/cgi/collection/council_on_sports_medicine_and_fitness).
36. American College of Sports Medicine. Position Stands accessed March 9, 2015, at [www.acsm.org/access-public-information/position-stands](http://www.acsm.org/access-public-information/position-stands) and Team Physician Consensus Conference Statements accessed March 9, 2015, at [www.acsm.org/access-public-information/team-physician-consensus-conference-statements](http://www.acsm.org/access-public-information/team-physician-consensus-conference-statements).
37. American Orthopaedic Society for Sports Medicine. Consensus Statements. Accessed March 9, 2015, at [www.sportsmed.org/Education/Resources/Consensus\\_Statements/](http://www.sportsmed.org/Education/Resources/Consensus_Statements/).
38. National Athletic Trainers' Association. Public Resources. Accessed March 9, 2015, at [www.nata.org/Public](http://www.nata.org/Public) and at Position Statements, [www.nata.org/position-statements](http://www.nata.org/position-statements).
39. National Center for Catastrophic Sport Injury Research. Main website. Accessed March 9, 2015, at [nccsir.unc.edu/](http://nccsir.unc.edu/).
40. National High School Sports-Related Injury Surveillance Study (High School RIO). Accessed March 9, 2015, at [www.ucdenver.edu/academics/colleges/PublicHealth/research/ResearchProjects/piper/projects/RIO/Pages/default.aspx](http://www.ucdenver.edu/academics/colleges/PublicHealth/research/ResearchProjects/piper/projects/RIO/Pages/default.aspx).
41. Datalys Center. Resources. Accessed March 9, 2015, at [datalyscenter.org/resources-1/](http://datalyscenter.org/resources-1/).
42. MacKay M, Scanlan A, Olsen L, Reid D, Clark M, McKim K, Raina P (2004). Looking for the Evidence: a Systematic Review of Prevention Strategies Addressing Sport and Recreational Injury among Children and Youth. *Journal of Science and Medicine in Sport*, 7(1), 58–73.
43. Wingfield K, Matheson GO, Meeuwisse WH (2004). Preparticipation Evaluation: an Evidence-Based Review. *Clinical Journal of Sport Medicine*, 14(3), 109–22.
44. McGuine TA, Hetzel S, McCrea M, Brooks MA (2014). Protective Equipment and Player Characteristics Associated with the Incidence of Sport-Related Concussion in High School Football Players: a Multifactorial Prospective Study. *American Journal of Sports Medicine*, 42(10), 2470–8.
45. Anderson JC, Courson RW, Kleiner DM, McLoda TA (2002). National Athletic Trainers' Association Position Statement: Emergency Planning in Athletics. *Journal of Athletic Training*, 37(1), 99–104.
46. Gould D (2013). Effective Education and Development of Youth Sport Coaches. President's Council on Fitness, Sports & Nutrition, *Research Digest*, 14(4), 1–10.
47. National Federation of State High School Associations. Courses. Accessed March 9, 2015, at [nfhslearn.com/courses](http://nfhslearn.com/courses).
48. USA Football. Be a Better Coach. Accessed March 9, 2015, at [usafootball.com/coach](http://usafootball.com/coach).
49. USA Football. Youth Practice Guidelines: Set Limits on Practice Time, Amount of Full Contact. Accessed March 9, 2015, at [usafootball.com/blogs/heads-up-football/post/10006/youth-practice-guidelines-set-limits-on-practice-time-amount-of-full-contact-](http://usafootball.com/blogs/heads-up-football/post/10006/youth-practice-guidelines-set-limits-on-practice-time-amount-of-full-contact-).
50. McKay CD, Meeuwisse WH, Emery CA (2014). Informing Body Checking Policy in Youth Ice Hockey in Canada: A Discussion Meeting with Researchers and Community Stakeholders. *Canadian Journal of Public Health*, 105(6), e445–9.
51. Hagglund M, Atroshi I, Wagner P, Walden M (2013). Superior Compliance with a Neuromuscular Training Programme is Associated with Fewer ACL Injuries and Fewer Acute Knee Injuries in Female Adolescent Football Players: Secondary Analysis of an RCT. *British Journal of Sports Medicine*, 47(15), 974–9.
52. Centers for Disease Control and Prevention, National Center for Injury Prevention and Control. HEADS UP to Youth Sports. Accessed March 9, 2015, at [www.cdc.gov/headsup/youthsports/](http://www.cdc.gov/headsup/youthsports/).